

In the Claims

1. (Previously amended) A method for estimating reference frequency drift in an uninitialized navigation receiver from a local oscillator in a cellular telephone handset operating in standby mode, the method comprising the steps of:

associating a cellular telephone handset subject to standby mode operation in which a base station provides 20-msec bursts of frequency reference information about every 700-msec, with a navigation receiver requiring initialization;

during said standby mode operation, sampling said 20-msec bursts of frequency reference information from a base-station;

running a numeric controlled oscillator (NCO) at a nominal frequency;

periodically adjusting said NCO with samples obtained in the step of sampling such that said base station provides a basis for accurate frequency measurement through a series of updates that coincide with said 20-msec bursts of frequency reference information;

correlating both in-phase and quadrature-phase outputs of said NCO;

computing a navigation receiver reference frequency drift estimate from information derived in the step of correlating; and

using said drift estimate to improve initialization performance in said navigation receiver by reducing local oscillator frequency uncertainty.

2. (Previously amended) The method of claim 1, further comprising the step of:

building a reference sinewave from data output by said NCO and passing such as updates to the step of correlating.

3. (Currently amended) A circuit for estimating reference frequency drift in a navigation receiver, comprising:

a numeric controlled oscillator (NCO) for periodically receiving an NCO_value on which an NCO output frequency depends;

a first lookup table for approximating a sinewave from an inphase version of said NCO output frequency;

a first mixer connected to an output of the first lookup table and for combining it with a gated master clock (MCLK) signal, and providing further for an I-mix signal output;

an I-correlator for correlating said I-mix signal output and having an I-correlation output;

a second lookup table for approximating a cosine wave from a quadrature phase version of said NCO output frequency;

a second mixer connected to an output of the second lookup table and for combining it with said gated master

clock (MCLK) signal, and providing further for a Q-mix signal output;

means for sampling the signal of a VCO synchronized by an MCLK signal in those intervals of time when the VCO is instantaneously being locked to a precision carrier frequency signal from a wireless communications network;

a Q-correlator for correlating said Q-mix signal output and having an Q-correlation output;

a drift estimate output comprising said I-correlation and Q-correlation outputs; and

a local oscillator frequency-uncertainty reducing circuit that operates before said navigation receiver is initialized, and when a mobile telephone is operating in a standby mode, and for speeding up initialization by means for using a drift estimate represented at said I-correlation and Q-correlation outputs to improve initialization performance in said navigation receiver by reducing local oscillator frequency uncertainty.

4. (Previously amended) The circuit of claim 3, further comprising:

an NCO value holding latch for receiving a data from a firmware control program, and connected to gate said MCLK signal to the first and second mixers.

5. (Previously amended) The circuit of claim 3, further comprising:

an I-latch and a Q-latch providing for a register of said I-correlation and Q-correlation outputs accessible by a firmware control program.

6. (Currently amended) A frequency discriminator circuit for estimating the reference frequency drift in an uninitialized navigation receiver which is associated with a mobile telephone in standby mode that periodically locks to a precision carrier frequency broadcast signal of a wireless communications network, and comprising a master clock (MCLK) (208) that provides a local reference frequency to the navigation receiver, and a voltage controlled oscillator (VCO) signal (210) that is periodically corrected in standby-mode by said precision carrier frequency broadcast signal:

characterized by operating of the following when said mobile telephone is operating in standby mode,

a numeric controlled oscillator (NCO) (204) clocked by the MCLK (208) and loaded with an NCO value (206) to synthesize the frequency of the VCO signal (210);

a clock gate to sample the VCO signal (210) during those intervals of time when it is actively being locked to a precision carrier frequency signal broadcast by the wireless communications network;

a set of sine and cosine waveform generators (216, 218, 220) driven by the data output by said NCO (204) to form an in-phase (I-value) and a quadrature-phase (Q-value) signal;

an in-phase and quadrature-phase mixer (226, 227) to mix both the I-value and Q-value signals with an MCLK-gated signal (224) for an I-mix output and a Q-mix output;

an in-phase and quadrature-phase integrator (228, 230) to integrate said I-mix and Q-mix outputs; and

an in-phase and quadrature-phase latch (232, 234) to store a reference frequency drift estimate from the integrators ~~for the navigation receiver to reduce frequency uncertainty during its initialization ; and~~

a circuit to use said reference frequency estimate to reduce frequency uncertainty before a navigation receiver is initialized.

7. (Currently amended) A method for estimating reference frequency drift in a navigation receiver, comprising the steps of:

during standby operation of an associated mobile telephone handset, and before a navigation receiver is initialized and tracking a GPS satellite:

inputting (102) the signal of a voltage controlled oscillator (VCO) that can be locked to the precision carrier frequency signal of a wireless communications network that occurs

in bursts during standby mode and that are sensed by said associated mobile telephone handset;

characterized by,

sampling (104, 106) the signal of a VCO in those intervals of time when the VCO is locked to the precision carrier frequency signal of a wireless communications network;

running (108) a numeric controlled oscillator (NCO) at a nominal frequency;

building (110) sine and cosine waves from data output by said NCO to form an in-phase and a quadrature-phase signal;

mixing both the in-phase and quadrature-phase signals with the sampled VCO signal;

integrating (112, 114) both the mixed in-phase and the mixed quadrature-phase signals over a pre-detection interval of time;

computing (118) a navigation receiver reference drift estimate from information derived in consecutive steps of integrating; and

adjusting the nominal frequency of said NCO with results obtained in the step of computing.

8. (Previously added) The method of Claim 7, wherein the pre-detection interval is shorter than half the period of the largest deviation from the reference frequency that is to be detected.

9. (Previously added) The method of Claim 7, wherein consecutive estimates are collected and averaged to further reduce the error.